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(54) Support matrix for I.C. engine exhaust catalysts

(57) A support matrix for a catalytic reactor for treating exhaust gases in an internal combustion engine, is composed of layers of alternating steel panels 2, 3 at least some of which are coated with a catalyst and at least one of which is corrugated so as to form flow channels for the exhaust gases. In order to increase the turbulence of the flow in the channels of the matrix, the smooth panel and/or the corrugated panel is sub-divided into narrow strips 3', 3", 3"' which lie adjacent to one another and are encountered sequentially by the inflowing exhaust gas. Furthermore, the exhaust gases which are divided into small streams may recombine between the strips and thus encounter renewed admixture. They are then redivided in the subsequent strip resulting in an overall intensive contact of each gas stream thread with a surface of the subsequent narrow strip.

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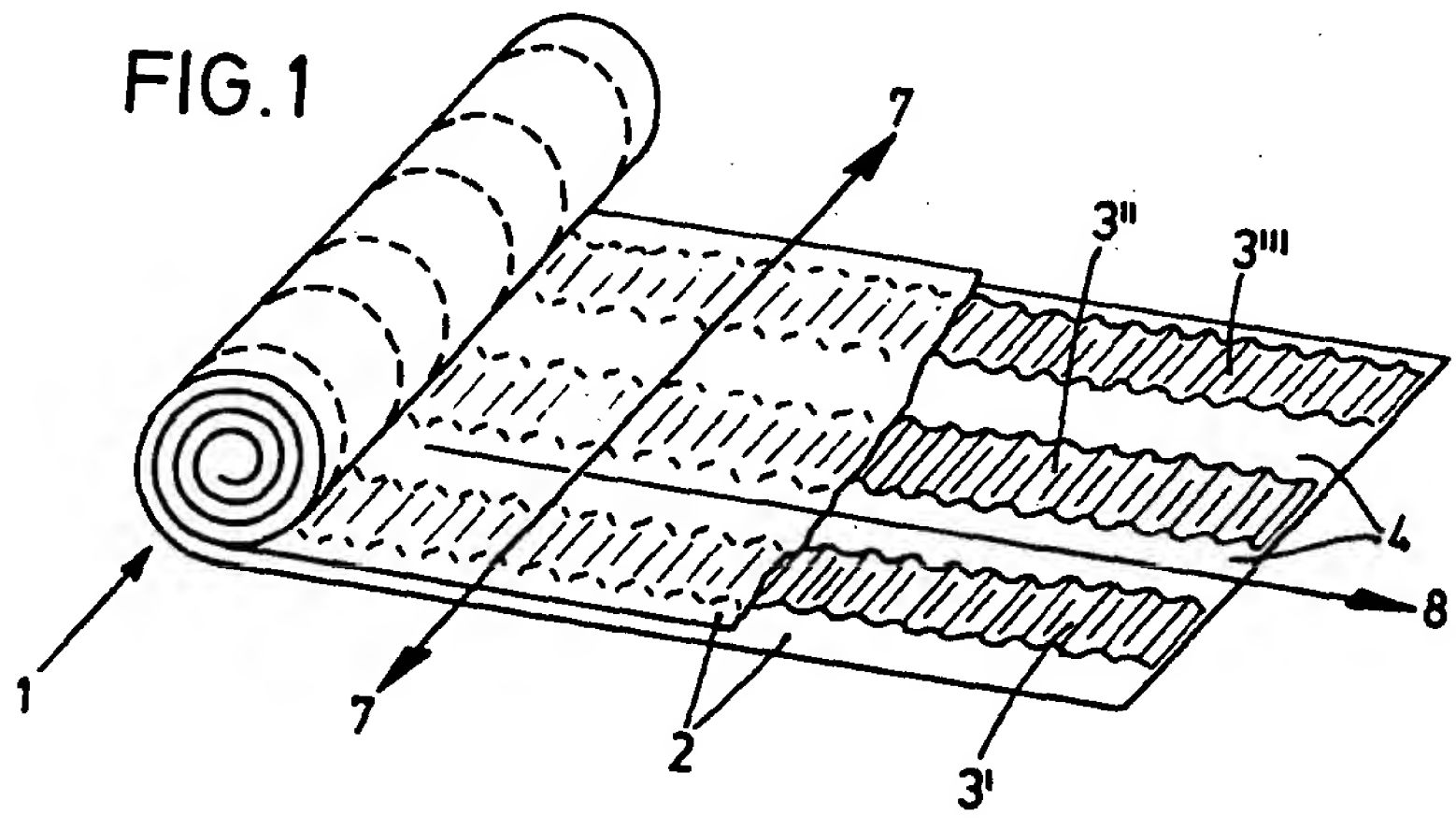
FIG.1



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SPECIFICATION

Support matrix for a catalytic reactor for scrubbing exhaust gases in an internal combustion engine

The invention relates to a support matrix for a catalytic reactor for scrubbing exhaust gases in internal combustion engines.

A support matrix of this type is known from GB Patent Specification No. 1,452,982 which discloses a support matrix especially for engines in motor vehicles, made of high temperature resistant steel, composed of alternating steel panels, at least one of which is corrugated, whereby the steel panels are coated with catalyst before the support matrix is assembled, or coated after the support matrix has been assembled.

In this known support matrix, the individual layers of steel panels can be welded together. The support matrix itself can be retained in a jacket by holding means, preferably disposed in front of the end of the matrix, this holding means consisting for example, of intersecting struts, wires or rods, or a wire mesh.

Welding the individual layers of steel panelling is a costly procedure and the holding means at the ends of the matrix do not always suffice to prevent a mutual axial displacement of the individual layers of the steel panels in the matrix.

In UK published specification No. 2001547A it had been proposed to prevent the axial displacement of the layers within the support matrix as well as to provide for turbulence of gases in the channels of the matrix by fabricating at least one steel panel or steel strip of the matrix with projections and/or depressions. In particular, the depressions were to be embodied as holes or openings in the smooth steel panel only. Alternatively, the holes might be placed exclusively in the corrugated steel panels.

It is an object of the present invention to provide an improvement to the known support matrix described in published specification No. 2001547A which results in the generation of very intensive turbulence of the gas flow through the catalytic reactor and thus makes possible a substantial shortening of the length of the matrix.

According to the present invention there is provided a support matrix for a catalytic reactor for scrubbing exhaust gases of internal combustion engines, comprising alternating steel panels coated with catalyst, at least one of said panels being corrugated, and at least one of the steel panels being provided with projections and/or depressions, said depressions being apertures and wherein said apertures extend over the entire longitudinal extent of the panel, thereby separating at least one of said panels into narrow strips disposed at a transverse separation from one another. The net result of this disposition is that, in the direction of gas flow, a number of isolated narrow metal strips is encountered.

The construction of the matrix results in a mixture of the gas flow between the individual narrow strips and the mixture is then again divided in the subsequent narrow strip so that newly formed threads of gas which had not been in contact with the surface of the previous strip now come in contact with the new strip. This type of flow substantially improves the catalytic effectiveness of the matrix which makes it possible to construct a reactor which is shorter in the direction of gas flow. This shortened construction in turn results in cost savings, space savings and a reduction in overall weight.

In one embodiment of the invention, the narrow strips may be smooth and/or corrugated. In a further characteristic of the invention, the narrow strips are located alongside one another, i.e., behind one another in the direction of gas flow and are separated from one another in that direction by a distance which is less than or equal to 25 mm, permitting a mixture of the gas flow in the spaces between the strips.

The general catalytic effectiveness is increased by providing as many narrow strips adjacent to one another as possible. The difficulty of constructing a matrix having so many strips requires a compromise solution in which the width of each of the strips in the direction of gas flow is less than or equal to 50 mm.

In a further advantageous embodiment of the invention, the strips or panels have corrugations of varying character. The character of the corrugations may be changed by changing the amplitude, the effective wavelength of the corrugations and/or the inclination, i.e., the direction of the wave in the corrugation.

A particularly advantageous embodiment is one in which the amplitudes of the corrugation of adjacent strips is different. However, it is also possible independently thereof or in addition thereto to alter the wavelength of corrugations in adjacent strips which ensures that even when the strips are very close to one another, they are encountered by always regenerated gas flow threads.

The different corrugation may also take the form of decreasing the effective wavelength of the corrugations in the direction of gas flow which is advantageous when exhaust gases containing solids are processed because the soiling of the matrix is then delayed.

In one embodiment of the invention, the corrugation of adjacent and/or sequential corrugated strips or panels may change. In a particularly advantageous embodiment of the invention, the angle which the corrugations make with a reference line, preferably the direction of gas flow through the matrix, could be different or in the opposite sense from one strip to the next.

In still another embodiment of the invention, it is advantageous to provide at least one of the panels or strips in a particular layer with additional apertures which are so disposed as to be covered by strips of the next layer of the matrix.

It may also be advantageous according to one embodiment of the invention to change the thickness of adjacent or sequential strips.

In still another embodiment of the invention, the entire matrix is composed of corrugated bands in which the waves of the corrugation extend obliquely over the entire width of the band.

Preferred embodiments of the invention will now

common matrix 1. It two separate pairs of geared rollers 10, 11 are available, the two bands 3^{I} and 3^{II} may be produced and rolled up simultaneously.

It is also possible, in a manner not shown, to change the overall thickness of adjacent or neighboring bands or strips. For example, the thickness of the smooth bands 2 may be chosen to be greater than the thickness of the corrugated band 3 or vice versa.

Furthermore, the shape of the individual corrugations in the bands 3 or strips 3', 3", etc. may be other than sinusoidal. In particular, it may be of triangular cross section or may meander in a sequence of arcs such as semi-circles. Still other forms of individual corrugations are possible. The sinusoidal form of corrugation is illustrated in Figure 7. The matrix 1 may be constructed as generally indicated in Figure 1 by rolling up a sandwich of bands and strips. Alternatively however, it can be constructed of a block of flat bands 2, 3 piled one on top of the other.

While the invention has been described in a number of preferred embodiments, it is to be understood that these serve entirely for the purpose of illustration and explanation rather than for limitation. In particular, features of one embodiment may be usable in another.

CLAIMS

1. A support matrix for a catalytic reactor for scrubbing exhaust gases of internal combustion engines, comprising alternating steel panels coated with catalyst, at least one of said panels being corrugated, and at least one of the steel panels being provided with projections and/or depressions, said depressions being apertures and wherein said apertures extend over the entire longitudinal extent of the panel, thereby separating at least one of said panels into narrow strips disposed at a transverse separation from one another.

2. A matrix according to claim 1, wherein the separate strips are smooth.

3. A matrix according to claim 1, wherein the separate strips are corrugated.

4. A matrix according to claim 1, 2 or 3 wherein said strips are separated from one another in the direction of gas flow by a distance which is less than or equal to 25 mm.

5. A matrix according to claim 1, 2, 3 or 4 wherein the width of said strips in the direction of gas flow is less than or equal to 50 mm.

6. A matrix according to any one of claims 1 to 5, wherein the corrugations of adjacent panels have a different character.

7. A matrix according to any one of claims 3 to 6 wherein the amplitude of corrugations of panels in neighboring layers is different.

8. A matrix according to claim 6, wherein the wavelength of corrugations of adjacent panels is different.

9. A matrix according to claim 8, wherein the wavelength of adjacent panels in the direction of gas flow decreases.

10. A matrix according to any one of claims 3 to 9 wherein the waves of the corrugation make an angle other than zero degrees with the direction of gas flow through the matrix.

11. A matrix according to claim 10, wherein the angle between the waves of the corrugation and the direction of gas flow of adjacent component panels or strips of the matrix alternates in algebraic sign.

12. A matrix according to claim 10, wherein the angle of adjacent corrugations is alternatingly different.

13. A matrix according to any one of claims 1 to 12 in which at least one of the component steel parts of the matrix has additional apertures while the neighboring layer of components is disposed in the vicinity of said additional aertures.

14. A matrix according to claim 13, wherein said additional apertures extend over the entire length of the component of the matrix, thereby separating the second one of the panels into separate strips and wherein strips of neighboring layers overlap.

15. A matrix according to any one of claims 1 to 14 wherein the thickness of adjacent or neighboring panels varies.

16. A matrix according to claim 1, wherein all steel panels of the matrix are corrugated and the corrugations extend over the entire width of the panels in a direction oblique with respect to the direction of gas flow.

17. A support matrix for a catalytic reactor for scrubbing exhaust gases of internal combustion engines substantially as described herein, with reference to and as illustrated in, any one or more of the accompanying drawings.

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FIG.1

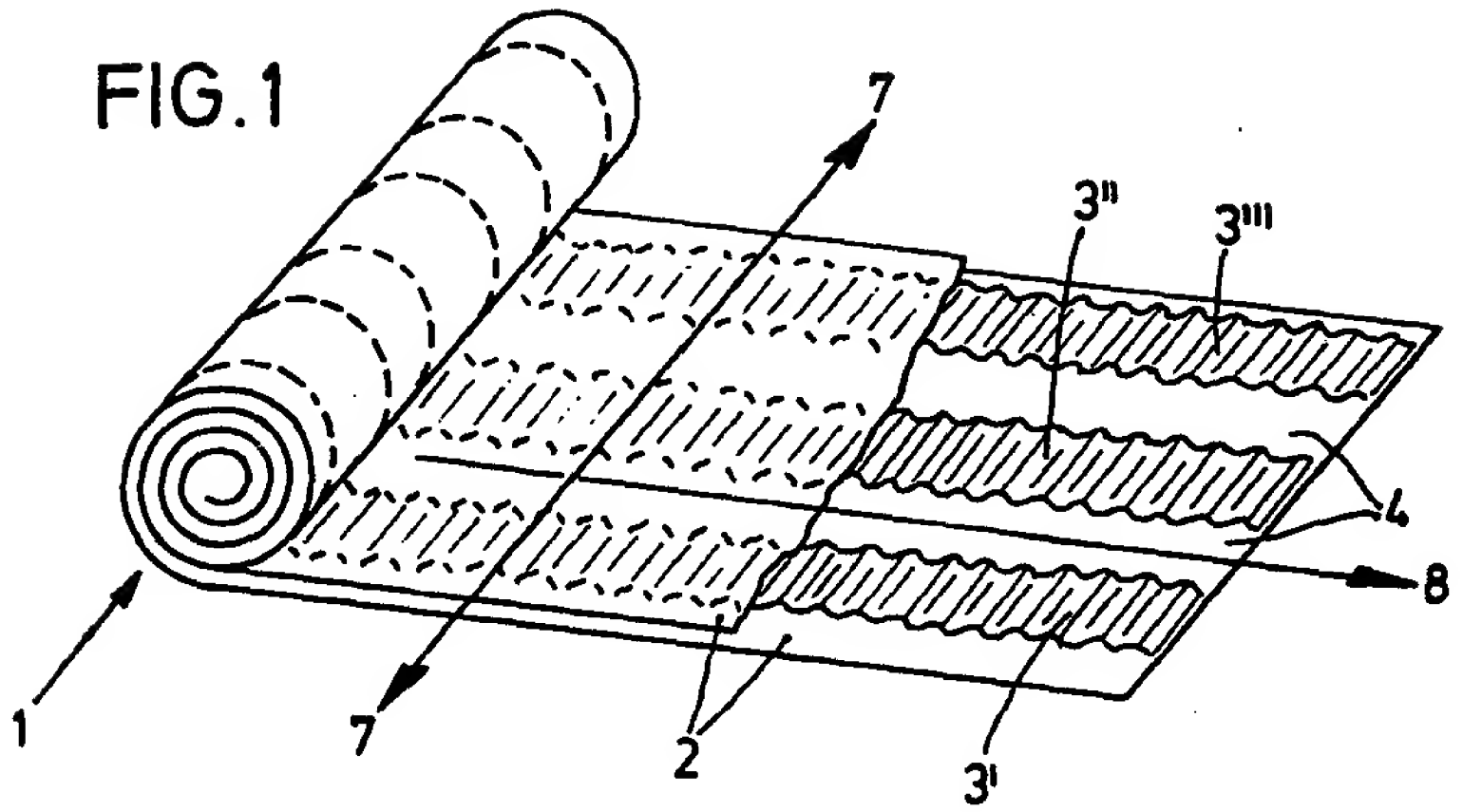
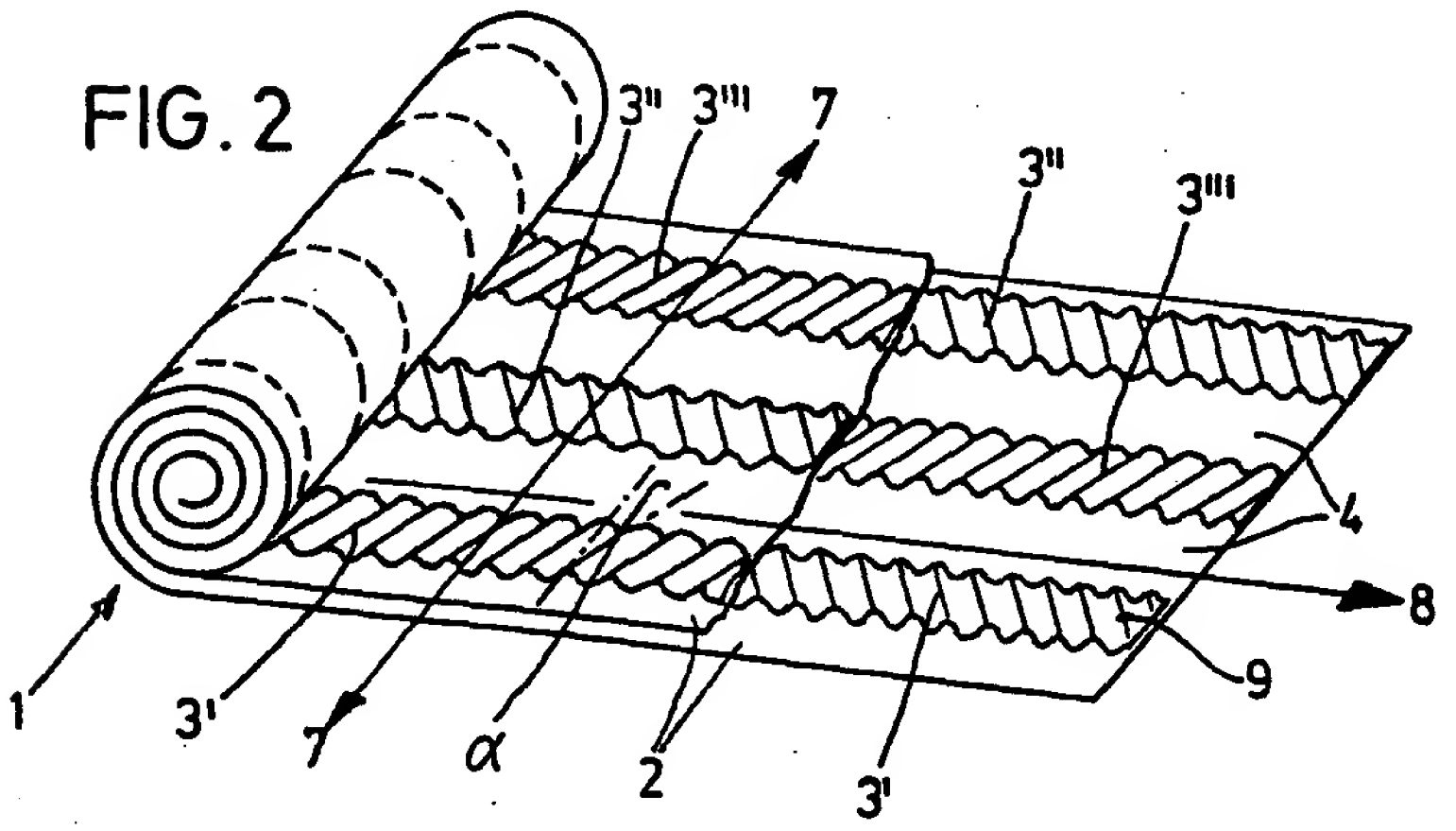


FIG.2



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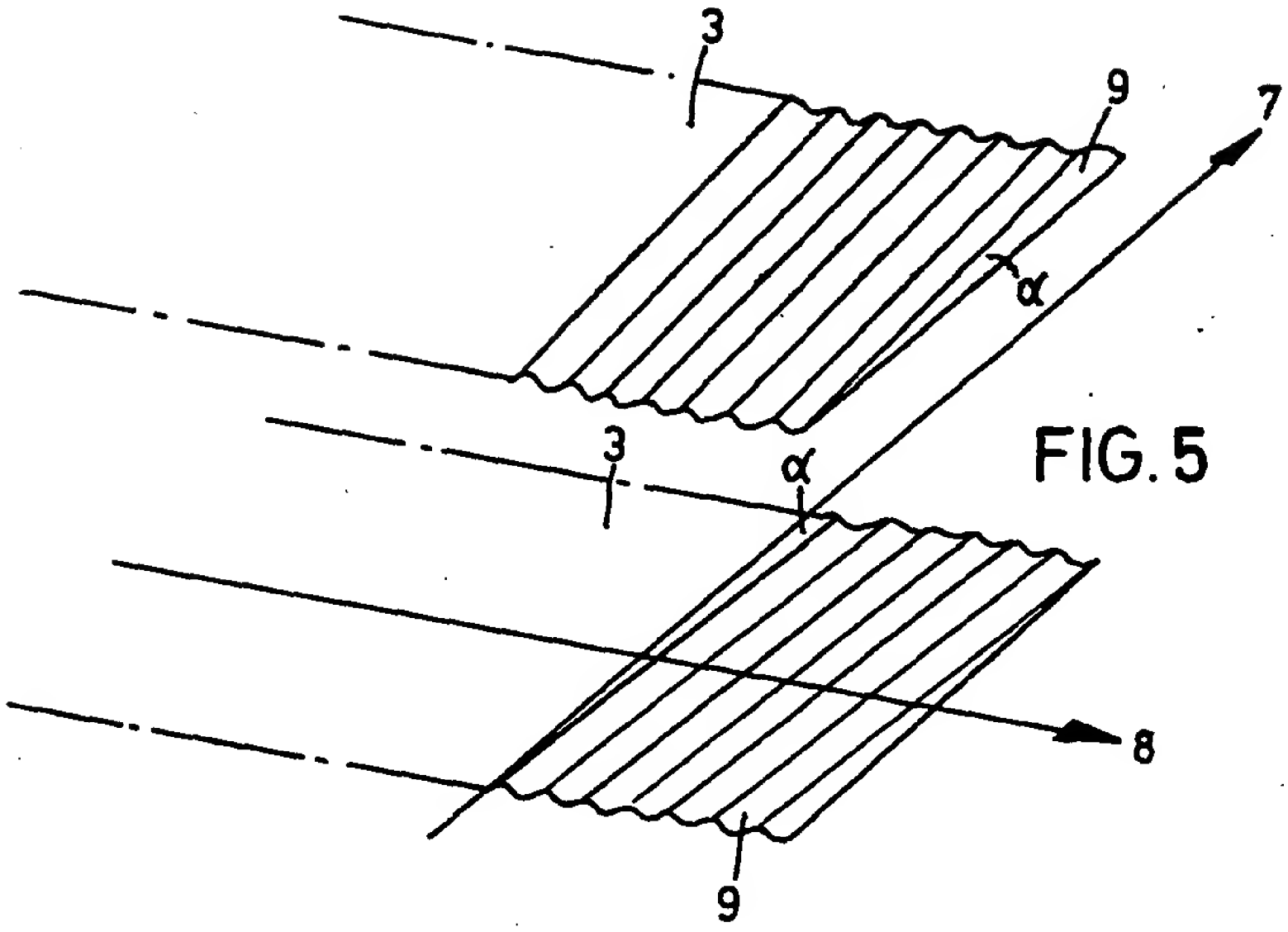

FIG.5

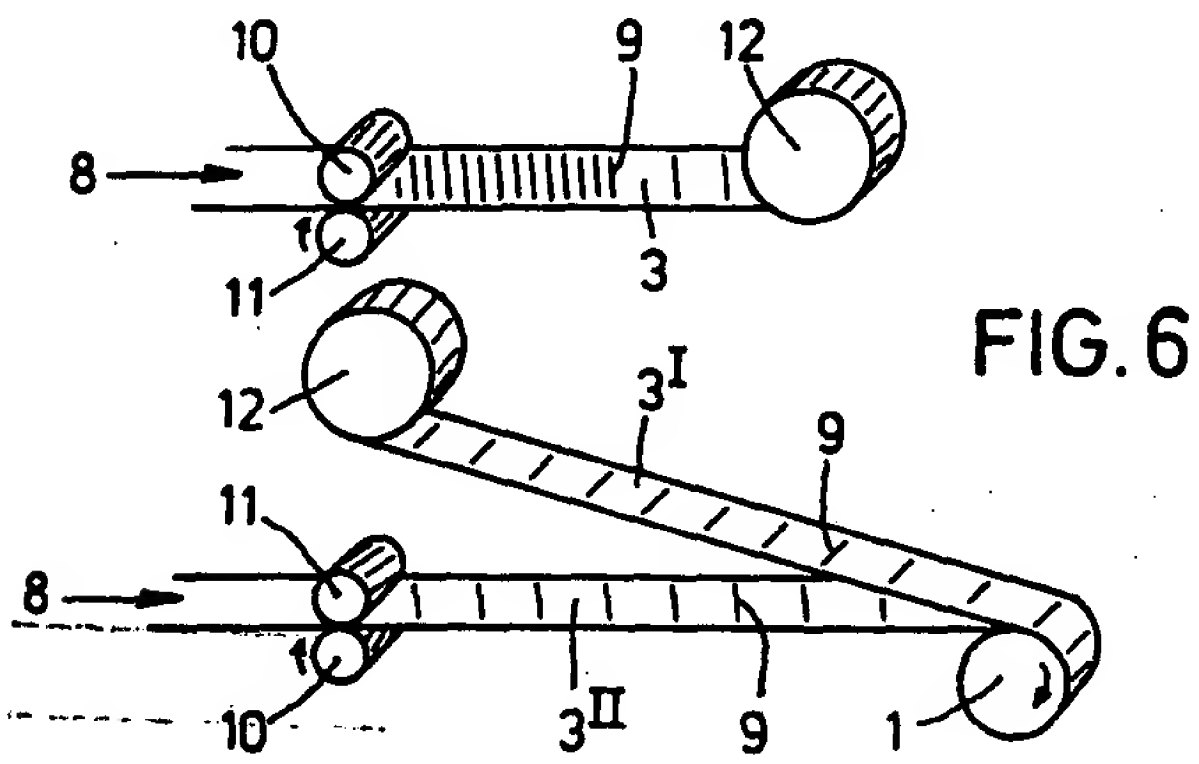

FIG.6

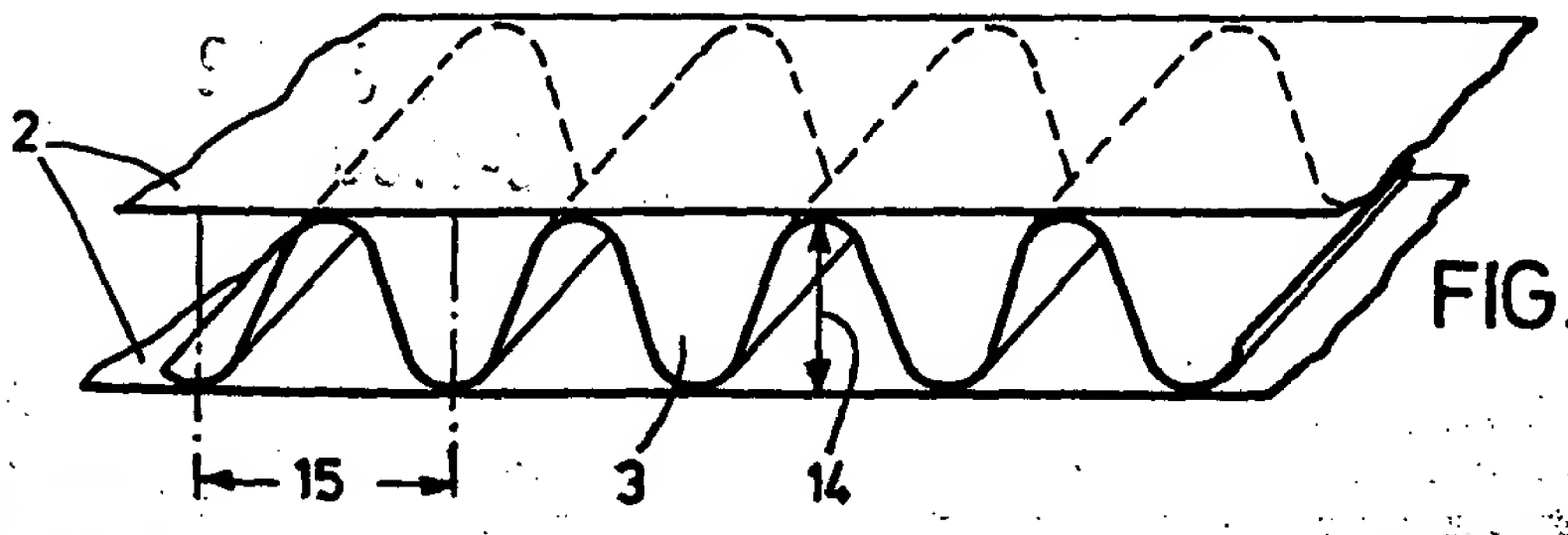

FIG.7

DOCKET NO: E-41365

SERIAL NO: 09/998,724

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